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ABSTRACT

Ways in which middle schools can better prepare their students are presented in this report. It discusses the national pattern of underachievement in basic mathematics and science and details how schools served by the Southern Regional Education Board (SREB) report that almost 50 percent of their eighth-graders are below the basic level in math. Of particular concern are students in low-income districts, from rural areas, and girls. The report explores why these gaps in performance exist and what can be done to ease them. One method is to revaluate the standards and expectations of middle schools and redirect the current emphasis from arithmetic to higher mathematics, such as geometry and algebra. Deciding what students are expected to know is vital to the process, in particular, schools must determine what constitutes high standards and expectations. Parents, also, must be brought into any reform efforts. More information about classroom practices is needed. Suggestions as to how states can evaluate student performance and an example that compares a high-performing to a low-performing school are offered. (RJM)

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ED 419 278

SREB

# Education's Weak Link: Student Performance in the Middle Grades

March 1998

Southern
Regional
Education
Board

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*This is the first in a series of reports funded by a grant from the Edna McConnell Clark Foundation.*

**The middle grades—grades five through eight—are the weak link in American education. Nowhere is the link more fragile than in the states served by the Southern Regional Education Board.**

Data from the National Assessment of Educational Progress (NAEP) reveal that eighth grade students across America are unprepared for challenging high school work. Nationally, 39 percent of eighth graders who took the NAEP mathematics examination in 1996 scored below the "basic" level—indicating they lack the fundamental skills most Americans would agree are needed to be successful in high school.

The National Assessment statistics for the SREB states paint an even more disturbing picture. Consider that:

- Almost 50 percent of eighth graders are below the basic level in math.
- Even in the highest performing SREB states (Maryland, Texas and Virginia), more than 40 percent of eighth graders are below the basic level.
- In the two lowest performing SREB states (Louisiana and Mississippi), nearly two/thirds of eighth graders are below the basic level. (Figure 1)

## A National Pattern of Underachievement

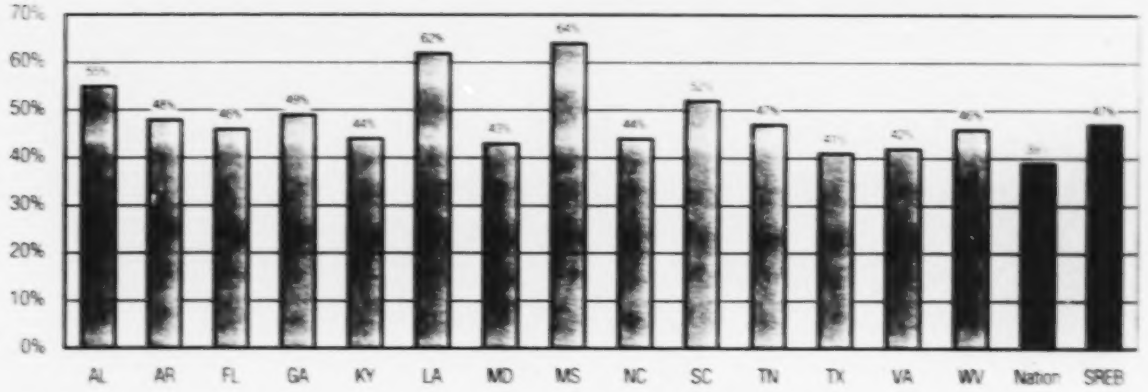
Eighth grade performance indicators from the National Assessment of Educational Progress reveal a discouraging pattern of middle grades underachievement nationwide. They describe students who:

- Can do arithmetic but do not understand and cannot apply concepts such as number relationships expressed as ratios or percentages to problems that need several steps to solve;
- Can memorize facts and answer specific science questions but cannot apply the knowledge nor understand the reasoning behind scientific concepts; and
- Have only some of the reading skills necessary to be successful in grade level work.

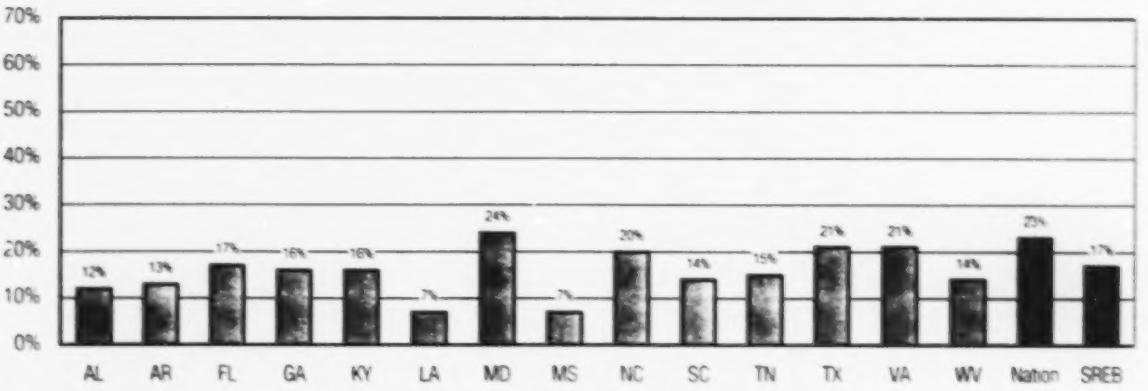
To be literate does not mean that we all must be physicists, astronomers, mathematicians or literary critics. It does mean that we should be able to read an article about business or science, understand it, and make good and accurate decisions about health and economic issues in our daily lives.

## Figure 1
## 1996 National Assessment of Educational Progress

### Percentage of 8th Grade Students Scoring Below *Basic* Mathematics Level




### Percentage of 8th Grade Students Scoring at the *Proficient* Level or Above on Mathematics




*NAEP 1996 Mathematics: Report Card for the Nation and the States*, National Center for Education Statistics

* Fourteen of the 15 SREB states participated in the 1996 NAEP; Oklahoma did not participate

The story is much the same in reading and science—too many students do not have the basic skills. Students have not acquired the solid foundation of knowledge and skills in core academic areas necessary to do challenging work in high school or to go on to further education in colleges and universities. In 13 of 14 SREB states with National Assessment data, more students score below the basic level in mathematics at eighth grade than at fourth grade.

The achievement gap is not only at the basic level. There are too few students in the SREB region who score at the proficient level on the National Assessment of Educational Progress, that is, prepared to do solid academic work. Fewer than one in four eighth grade students in all SREB states score at the proficient level in mathematics—a level that may signal that students are ready to do challenging high school work. (Figure 1)

## Figure 2
### Percentages of 8th Grade Students at Mathematics Performance Levels on the 1996 National Assessment of Educational Progress

| | | Percent of students who scored at performance levels | | | |
|---|---|---|---|---|---|
| | Total Percent of Students | Advanced | Proficient and above | Basic [1] and above | Below Basic |
| *White* | | | | | |
| SREB * | 59% | 3% | 24% | 68% | 32% |
| Nation | 68 | 5 | 30 | 73 | 27 |
| *Black* | | | | | |
| SREB | 24 | .1 | 3 | 24 | 76 |
| Nation | 15 | .1 | 4 | 27 | 73 |
| *Hispanic* | | | | | |
| SREB | 14 | .7 | 8 | 39 | 61 |
| Nation | 13 | .9 | 8 | 37 | 63 |

Shading - Statistically significant differences between SREB and nation

[1] Basic and above includes proficient and advanced percentages

* Fourteen of the 15 SREB states participated in the 1996 NAEP; Oklahoma did not participate

What accounts for this performance gap in the middle grades between SREB states and the nation? Do we expect students to know or to do less in SREB states? Another piece of data from the National Assessment suggests this may be true.

- **Eighth graders in SREB states who receive "B" or "C" grades in mathematics and science have lower NAEP scores than students with similar grades nationwide.**

With lower standards for middle graders than the rest of the nation, what does this mean for high school students who must meet higher standards in high school and take advanced course work in mathematics and science for graduation? And does this combination of low academic standards in the middle grades and tougher high school graduation requirements mean that fewer ninth grad rs in the SREB states will graduate and be prepared for work and college?

Finally, how does the poor performance of our middle grades affect the economies of SREB states—economies that depend on an educated workforce to compete? If eighth graders are not prepared to be successful in high school, the SREB region will not be able to produce enough qualified graduates for business, industry and education.

## Where are the student performance gaps?

There is a tendency to "blame away" the lower performance of middle grades students in SREB states by citing the region's higher poverty rate. But poverty does not account for the range of differences in mathematics and science achievement compared to the nation as a whole. SREB states have more low-income families and higher percentages of African-American students who are

more often from lower income families. The gap between NAEP scores for African-American and Hispanic students when compared to white students is similar, and unacceptably large, for both the SREB region and the nation. (Figure 2)

- **But the fact is: Students from low income families in the SREB region have lower achievement scores than low-income students across the nation.**
- **Added to this fact: In the SREB states, students with parents who graduated from high school or who had education beyond high school also have lower scores than students from similar families nationwide.**

For SREB states, there are two other factors associated with achievement: where students live and whether students are boys or girls.

- **Both male and female students in rural areas and small towns score significantly below students in rural areas nationwide. In fact, eighth graders in rural areas of the SREB region score about the same as their counterparts in inner cities. Nationally, rural students score higher than those in the central cities. (Figure 3)**
- **Female students—more than half the school age population in SREB states—perform at a lower level in mathematics and science than other female students across the country and consistently below male SREB students. (Figure 4)**
- **The largest achievement gap among females occurs between girls who live in rural areas of the SREB states and girls elsewhere in the nation who live in rural areas.**

## Figure 3
## Percentages of 8th Grade Students at Mathematics Performance Levels on the 1996 National Assessment of Educational Progress by Location

| | | Percent of students who scored at performance levels | | | |
|---|---|---|---|---|---|
| | Total Percent of Students | Advanced | Proficient and above | Basic [1] and above | Below Basic |
| *Central City* | | | | | |
| SREB * | 33% | 2% | 17% | 50% | 50% |
| Nation | 29 | 3 | 16 | 48 | 53 |
| *Urban Fringe/Large Town* | | | | | |
| SREB | 35 | 3 | 21 | 60 | 40 |
| Nation | 38 | 5 | 26 | 64 | 36 |
| *Rural/Small Town* | | | | | |
| SREB | 32 | 1 | **13** | **50** | **50** |
| Nation | 33 | 3 | 25 | 69 | 31 |

Shading - Statistically significant difference between SREB and nation

[1] Basic and above includes proficient and advanced (Percentages are rounded and may not total 100)

* Fourteen of the 15 SREB states participated in the 1996 NAEP; Oklahoma did not participate

## Figure 4
## Average Mathematics Performance Score by Content Areas on 1996 National Assessment of Educational Progress by Gender

| Gender | Number sense, properties, operations | Measurement | Geometry | Data analysis, statistics, probability | Algebra |
|---|---|---|---|---|---|
| *Male* | | | | | |
| SREB * | 269 | **262** | **264** | 265 | 268 |
| Nation | 272 | 269 | 268 | 269 | 272 |
| *Female* | | | | | |
| SREB | **267** | **256** | **261** | **263** | **267** |
| Nation | 273 | 267 | 269 | 272 | 272 |

Shading - Statistically significant difference between SREB and the nation

* Fourteen of the 15 SREB states participated in the 1996 NAEP; Oklahoma did not participate

**The challenge to states, districts and schools is twofold: (1) to determine why SREB students perform more poorly when compared to similar students nationwide and (2) to develop practices that help *all* students—those in cities and rural areas, girls and boys—raise their academic achievement.**

## Why do the gaps exist?

What is different for female students and rural students in SREB states? Are expectations different? On average, female students in the South receive higher grades than females nationwide, yet they score significantly below other females in the nation on the National Assessment.

Why this gap? Are the standards different in rural areas? Eighth grade girls in rural areas of the SREB states report that in science class they do fewer hands-on tasks involving concepts associated with electricity, simple machines and scientific measurement tools. Hands-on tasks are important preparation for challenging science courses in high school.

Have our states, districts and schools set clear, challenging standards for what eighth graders should know before they enter high school? Are there also problems with what content is being taught and how students are being taught? Do parents know what the standards and expectations are for the middle grades? Are parents willing to have their children struggle with more difficult and challenging work?

These are questions that many leaders in SREB states are beginning to ask. In virtually every SREB state, data from statewide assessments of student progress point to weaknesses in middle grades achievement. In Kentucky, for example, a committee is trying to determine why middle school performance on Kentucky's statewide testing program is lagging behind elementary and high school performance.

No single explanation is likely to resolve all of these questions. Part of the answer might be found in the evolution of the "middle school concept"—a nationwide phenomenon that began two decades ago—which many researchers contend lessened the importance of academic achievement. Based on the data cited here, the explanation for the middle grades "achievement gap" in the SREB states appears to be even more complex—rooted, perhaps, in a history of lower standards and expectations.

## Standards and Expectations

What should students know and be able to do to be successful in high school and beyond? Do we expect as much from our students as other states? International, national and state test results suggest that, in at least some cases, we have lower standards and expectations for eighth grade students.

We know that American students are not performing at the highest levels on international comparisons of achievement. Yet education leaders in only two of the 15 SREB states report that they have compared state content standards in mathematics and science with international benchmarks for eighth grade performance. What does that say about mathematics standards and expectations in states where students score significantly below the national average?

Algebra is often described as the "gatekeeper" for advanced mathematics and for entrance into college. About 25 percent of students in the SREB states take algebra by the end of the eighth grade—the same as the national average. Yet eighth graders in over half of the SREB states score below the national average on the algebra part of the NAEP assessment. (Figure 5)

Another 35 percent of eighth graders say they will take algebra in ninth grade, leaving almost 40 percent who do not plan to begin a higher mathematics sequence—algebra, geometry and algebra II—in high school. All SREB states require three years of mathematics for high school graduation and admission to postsecondary education, but the requirement can be met by a variety of mathematics courses. Currently, algebra I is the highest level of mathematics required of all students. However, about one/third of SREB states have raised that requirement to include both algebra and geometry for future graduating classes. More entry level jobs require technical, mathematical knowledge. Yet we still have a third of students in SREB states who reported that if given the option, they would not take mathematics at all in high school.

## Eighth Graders: A World View

- American eighth graders have improved their performance in arithmetic while the rest of the world has moved on to problem-solving, algebra and geometry.
- "Basic" mathematics for American eighth graders is the same as seventh grade mathematics for most of the world.
- Most American eighth graders (86%) think that they are doing well in mathematics while more than half of Japanese and Korean students (who are doing well) think they should do better.

*Mathematics Achievement in the Middle School Years: IEA's Third International Mathematics and Science Study*, 1996.
*A Splintered Vision: An Investigation of U.S. Science and Mathematics Education*, 1997.

## Figure 5
## SREB State* Performance in 8th Grade Mathematics on 1996 National Assessment of Educational Progress

(↓ = Below National Average, ↔ = Same as National Average, ↑ = Above National Average)

| Content Topics | AL | AR | FL | GA | KY | LA | MD | MS | NC | SC | TN | TX | VA | WV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number Sense, properties, operations | ↓ | ↓ | ↓ | ↓ | ↔ | ↓ | ↔ | ↓ | ↔ | ↓ | ↓ | ↔ | ↔ | ↔ |
| Measurement | ↓ | ↓ | ↓ | ↓ | ↔ | ↓ | ↔ | ↓ | ↓ | ↓ | ↓ | ↔ | ↔ | ↓ |
| Geometry | ↓ | ↓ | ↓ | ↓ | ↔ | ↓ | ↔ | ↓ | ↔ | ↓ | ↓ | ↔ | ↔ | ↓ |
| Data Analysis, statistics, probability | ↓ | ↓ | ↔ | ↓ | ↔ | ↓ | ↔ | ↓ | ↔ | ↓ | ↓ | ↔ | ↔ | ↓ |
| Algebra | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↔ | ↓ | ↔ | ↓ | ↓ | ↔ | ↔ | ↓ |

*NAEP 1996 Mathematics: Report Card for the Nation and the States*, National Center for Education Statistics

* SREB states that participated in the 1996 National Assessment of Educational Progress mathematics test are included here.

If two out of five students fail to see the importance of mathematics to high school and career success, what should we do in the middle grades to motivate students to succeed in mathematics? What standards do we expect middle grades students to meet in mathematics and the other core subjects—and do those standards reflect the tougher high school graduation requirements most SREB states have now implemented?

### Parent support and school practices

Deciding what we expect students to know and do is the first step in shrinking the achievement gap in the middle grades. Many states in the nation and the SREB region are developing or refining academic standards and expectations for students in all grades. But after standards are developed and expectations defined, what next? Do students, teachers and parents know what the standards are and what performance is expected? The next all-important step is to make sure that all parts of the education system are organized to achieve the standards.

*What do the National Assessment data tell us about how well schools in the SREB states communicate with students and parents about standards and expectations?*

- Fewer schools in SREB states, especially in rural areas and small towns, report positive parental support.
- Eighth grade students in schools with positive parent support for student achievement in SREB states score the same as eighth graders nationwide.
- Fewer schools in SREB states report that parents are involved in classroom activities, parent conferences and curriculum matters.
- Students in schools with parents involved in classroom activities, parent conferences and curriculum matters in SREB states score the same as eighth graders across the nation.

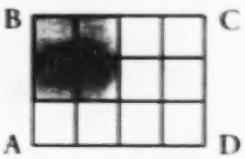
# What Do We Mean by High Standards and Expectations?

What should SREB states expect eighth grade students to know and be able to do? What does the nation expect? The National Assessment began using the terms basic, proficient and advanced in 1990 to describe performance in mathematics and reading.

These proficiency levels are based on high standards and expectations for students and are applied to student performance nationwide.

Students who perform at the basic level have some knowledge and skills needed to do grade-level work, but they have not mastered all the skills they will need. At the proficient level, students can achieve a solid academic performance and are able to demonstrate competency with challenging subject matter. Students who perform at an advanced level have achieved a superior performance beyond grade-level mastery. The following examples illustrate what students were asked to do on international and national tests of academic performance and what basic, proficient and advanced mean in the various content areas. The item in Example 1 is designed to measure number sense and properties.

Example 1




In the figure above, what fraction of rectangle ABCD is shaded?

A. 1/6 B. 1/5 C. 1/4 D. 1/3 E. 1/2

The correct answer is D. Multiple-choice question measures number sense, properties, and operations

*About 16 percent of 8th graders in SREB states who scored below the basic level could answer this question correctly.*

The National Assessment of Educational Progress sampled science achievement in 44 states as part of the 1996 Report Card. The assessment covered earth, physical and life sciences and included multiple choice questions, questions that required students to write a response, and a hands-on science task.

The question shown in Example 2 required a student to write a response and to use knowledge acquired in life science and practical reasoning in describing how to prevent food poisoning.

*Only 10% of American 8th graders could describe a cause of food poisoning and a way to prevent it.*

Example 2

A group of students took potato salad made with mayonnaise to a picnic on a very hot day. Explain how eating the potato salad could cause food poisoning.

When mayonnaise gets to hot it starts growing poisonious bactrias which can give you food poisoning

Describe something that could be done to the potato salad to prevent the people who eat it from getting food poisoning.

It can be kept in a cooler and stay cool until they want to eat it. then they should put it back in the cooler.

Example 3

*The most recent national information available on eighth grade performance in reading was collected in 1992 and 1994. Seventy percent of eighth grade students did not achieve at a proficient level—solid academic performance on challenging subject matter. Students were asked to read to gain information from an informative article. The following example asked students to interpret information.*

### The Lost People of Mesa Verde

"The Lost People of Mesa Verde" refers to the Anasazi, Native Americans who lived peacefully for eight hundred years in Southwestern Colorado and then disappeared. This informative article (not included for this example) outlines their history, describes aspects of their ancient culture, and provides archeological and scientific explanation of their moves and disappearance.

**Question:**

**The three moves made by the Anasazi are listed below. Explain the possible reasons that were suggested in the article for each move.**

- 500-1200 A.D. The Anasazi moved from the alcoves to the top of Mesa Verde.
- 1200 A.D. The Anasazi moved back down into the alcoves in the cliffs.
- 1300 A.D. The Anasazi left Mesa Verde.

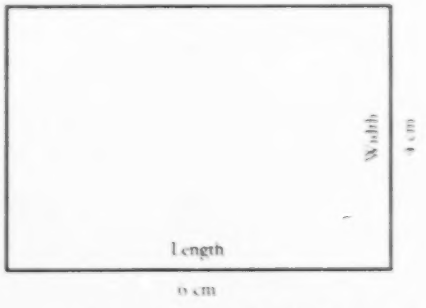
*Only 25 percent of 8th graders could identify from the article one reason for each move.*

*A complete response required a reason for each of the three moves by restating information from the article.*

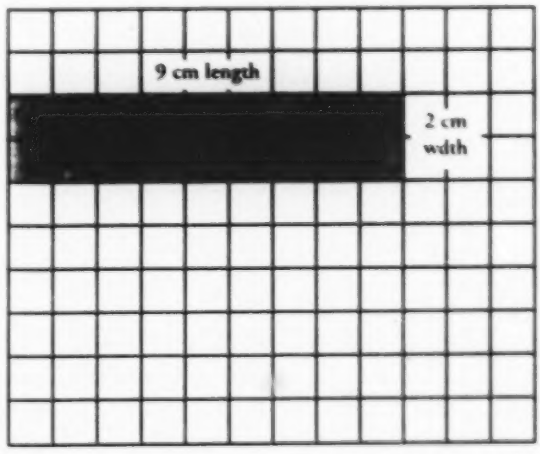
Geometry and measurement are content areas in which American performance is considerably weaker than the rest of the world. Example 4 is an item from the Third International Mathematics and Science Study designed to assess measurement and multi-step problem solving.

*Only 16 % of American 8th graders completed Example 4 correctly.*

Example 4




In the space across, draw a new rectangle whose length is one and one-half times the length of the rectangle above, and whose width is half the width of the rectangle above. Show the length and width of the new rectangle in centimeters on the figure.



Are schools in SREB states less welcoming to parents, less trusting, or less open about what is expected of students? The data suggest that schools with middle grades should find ways to involve parents in setting academic standards and building parent support for the standards. A first step is to communicate to students and parents alike a clear picture of the standards for completing eighth grade and what is acceptable performance.

*What does the Third International Mathematics and Science Study data tell us about how we organize content and develop activities within the curriculum?*

Most 13- and 14-year old students around the world study 10-15 topics each year in mathematics and study them in greater depth until they are mastered. In America, middle grade students "cover" or review as many as 35-40 topics a year—often the same 35-40 topics they have covered for several years.

- In fact, while most countries introduce six or seven new topics in algebra and geometry during the middle grades, most American students can count on studying only one new topic during this period.

About 75 percent of eighth graders in SREB states report doing problems from a textbook everyday. These students do not perform as well as students nationwide who report daily textbook use. Why the different result? How do teachers decide what to teach from the textbook, what to emphasize, and how much time to devote to different topics? Is the textbook the only curriculum in too many schools? Without a set of standards and indicators of acceptable performance, curricular results may vary significantly from classroom to classroom and school to school.

Interestingly, eighth grade students in the SREB states and across the nation perform better in science than in mathematics on international comparisons. Studies show that the U.S. curriculum is more focused in science than in mathematics, giving students more time and opportunity to master concepts and study a topic in more depth.

*What do we know about classroom practices?*

Information gathered by the National Assessment of Educational Progress from teachers and students tells us that in comparison to the nation, the typical eighth grader in SREB states:

- is assigned less group or partner work in mathematics;
- is assigned less project work in mathematics;
- writes less about how to solve problems in mathematics;
- believes mathematics is mostly about memorizing facts;
- designs and carries out fewer scientific investigations;
- gives fewer oral reports in science; and
- has fewer discussions about material they have read.

When students have fewer opportunities to deepen their understanding by applying what they have learned in different ways, their performance is diminished. Each of th :se characteristics results in lower scores for eighth graders in SREB states when compared to eighth graders across the nation.

*What do the National Assessment of Educational Progress data tell us about how schools in SREB states assess student progress?*

- Almost two/thirds of students in SREB states are tested at least weekly in mathematics by their teachers, and these students score about 30 points lower on the National Assessment of Educational Progress than students who are tested once or twice a month.
- A similar pattern in science shows that more frequent testing does not lead to better achievement.

It may be that students in classrooms that emphasize testing concentrate on learning bits of information that are not remembered or developed into a logical understanding of mathematics and science. Frequent testing coupled with fewer opportunities to apply learning appears to produce lower student achievement in classrooms.

## How Do States Evaluate Student Performance?

As part of public reporting responsibilities, states in the SREB region gather information they have on students and schools to try and determine progress on state standards for knowledge and performance.

Most of the states are either designing new assessment systems aligned with the state standards or fine tuning current systems. All of the states report on mathematics and reading/English achievement in some form; some report by district, but most report by individual schools. Six of the 15 SREB states report statewide data on science achievement at grade eight, and one state looks at science in grade seven. However, comparisons are not always available from year-to-year or across districts and schools because of different tests, different criteria, and local goals, objectives and assessments. The NAEP State Report Cards in mathematics provide the best comparative data for the SREB region, but these data are not linked to individual schools and districts.

Several SREB states have launched studies to examine standards and expectations in mathematics and science. For instance, Georgia has been concerned about the performance of juniors and seniors on the SAT. To try and understand the causes of lagging SAT scores, results from preliminary versions of the SAT given in seventh through tenth grades were analyzed. Georgia reached the following conclusions.

- Students in grades seven through ten do not understand ratio, place value and prime numbers;
- Students are not able to solve multi-step problems; that is, two of three students could not give the percent of a number when it was expressed in decimal form; and
- Students do not know or understand geometric relationships.

These shortcomings can be traced, in significant part, to weaknesses in the middle grades curriculum. For too many students in too many schools, achievement in mathematics and science does not progress at a desirable rate in the middle grades in SREB states. The instructional time cannot be regained.

The evidence of lagging achievement in the middle grades in SREB states is overwhelming and pervades the entire educational system. (Figure 6) To change what some refer to as a "culture of inability" in our schools and classrooms, we must challenge everyone responsible for middle grades achievement to examine data and consider what steps need to be taken to reverse course.

## Figure 6
## Middle Grades: The Weak Link
## Results from State Testing Programs

### Elementary

In Kentucky over the last five years, statewide reading scores have risen 31 points and statewide mathematics scores have risen 22 points in the elementary grades. The overall accountability index rose 13 points.

### Middle Grades

In reading, scores rose only 11 points over the last five years, much less than the growth rate expected by the state in the middle grades. Mathematics scores improved by 31 points. The overall accountability index improved by 9 points, the lowest gain of the three grade groups.

### High School

By twelfth grade, reading scores rose 34 points, a dramatic improvement, and mathematics scores improved by 28 points over the five-year period. The overall accountability index rose by 15 points.

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During the 1994-95 school year, South Carolina's fifth graders scored about the same as a national sample in mathematics. Twenty-five percent were in the lowest quarter of students and 28 percent scored in the upper quarter.

When these fifth graders were tested as seventh graders in 1996-97, the number of students in the lowest quarter had grown to 30 percent and the percentage in the upper quarter slipped to 26 percent.

For students moving from ninth to eleventh grade during the same time period, the percentage of students scoring in the highest quarter grew and the percentage in the lowest quarter decreased.

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At the end of third grade, Oklahoma students scored as well as 60 percent of students on a nationally-normed test in reading, 62 percent in mathematics and 69 percent in science. By the end of fifth grade no fewer than 76 percent of students passed all state-developed curriculum tests.

At the end of seventh grade Oklahoma students scored only as well as 57 percent of students on a nationally-normed test in reading, 58 percent in mathematics, and 55 percent in science. By the end of eighth grade, the percentage of students who passed the state's curriculum tests was lower in every area

The decrease in the percentage of students passing the curriculum tests continued in the eleventh grade except for reading where the percentage improved from eighth grade.

## Comparing a High-Performing and Low-Performing School

*One way to gain insight into the middle grades achievement gap is to compare a high performing school with a school in which students are not performing at an acceptable level. The following are snapshots of two such schools with a similar student body—a mix of racial/ethnic groups and a majority of students from low-income families.*

*A visit to a high performing school reveals a faculty and administration that is caring, enthusiastic and focused on high expectations for student success.*

### High-Performing

As you enter the door of High Performing Middle School, a hum of activity greets your ears. Bright and attractive displays of student work are posted in the hallways and in the rooms that you glimpse as you make your way to the office. Students greet you with a smile and ask if you need help.

The principal shares the standards for student learning in the school that were developed with community and parent advice. She suggests that you look for the content standards and samples of exemplary work to be achieved by students that are displayed in each and every classroom. She selects a student "buddy" for you to follow so that you get a flavor of what going to this school is like.

Jordan, your eighth grade student "buddy," is bouncing in his seat as the combined mathematics and science period begins. There are two teachers and a parent volunteer to work with 60 students during this 90 minute block of time. The students are sitting at tables that accommodate six students.

Ms. Jones begins the period with a brief review of the previous day's work on distance, speed and force and then asks, "How many of you have seen a water wheel?" Very few students raise their hands, so she begins to elicit what students know about water wheels from pictures, movies and stories. Students are directed to work in pairs and to identify the major characteristics of water wheels. After several minutes, students share their ideas with the whole class.

Next, each student is challenged to design an effective and efficient water wheel from the materials on the table. Students must sketch their design and estimate its speed and capability of lifting certain materials. After completing their sketch, they share their design with a partner and develop one best design from the two. The exercise is monitored by both teachers who roam the room asking questions, observing discussions and checking designs. As the noise level subsides and the pairs begin to complete the activity, Mr. Smith signals for attention and asks for volunteers to share how they began and completed the given task. Approximately 30 minutes have gone by quickly.

Ms. Jones sets the boundaries for the next part of the day's task. She instructs each table (of three pairs) to come up with one best design for a water wheel, sketch it, write why they chose it, and estimate its speed and power capability. After completing those tasks, each table must get a teacher's initial on the plan and estimate and then begin constructing and testing their

*(continued on page 14)*

## High-Performing (cont'd)

water wheel. Ms. Jones and Mr. Smith remind the students to record the results of their water wheel tests in their notebooks and write their observations and summary statements after completing the tests. The room begins buzzing with ideas, discoveries and disagreements. The teachers question the groups about their designs as they circulate through the room. The parent volunteer fills pails of water and provides an empty and a filled bucket for each table.

As the period draws to a close, Ms. Jones asks for volunteers to share the results of their experiment and any summary statements they have developed. Students are eager to share their results, and they speculate freely on why some designs worked and others did not. As students dismantle their designs, Mr. Smith assigns the homework for the evening. Each student is to write how they would change the group designed water wheel to make it faster and more powerful if they were to do the task again.

During the teachers' planning period, Ms. Jones and Mr. Smith explain that the activities observed were part of the instruction designed to help students achieve the following science standards:

- Students will plan and implement investigative procedures.
- Students will collect data, organize, analyze, evaluate, infer and predict trends.
- Students will recognize how to apply formulas and equations.
- Students will identify physical properties of various materials.

The observed task required students to learn about circumferences, diameters and radii and their relationship to each other as well as to rate and distance. The teachers wanted students to think about these concepts using the scientific process of hypothesizing, experimenting and evaluating. The task also supported content and skills being used by other members of the teaching team in an English and social studies unit on colonial America. The lesson observed was but one of several the team has planned to investigate energy and the environment.

The teachers shared a checklist they used to evaluate students' work during the class period. This checklist was shared with students in advance so everyone knew what was expected. Each student was checked on their initial design and estimates and upon the group's final design and justification of that design. Each student was required to record the results of the water wheel experiments in a laboratory notebook and to develop a summative statement based on the experiment that explained the relationships of circumference, radius, speed and power.

Ms. Jones and Mr. Smith also discussed problems students had with the task and strengths they noted during the period. They explain that later, when they have time to reflect more fully, they will examine the students' work closely and ask pointed questions of themselves about the quality of their lesson plan and how it could be improved.

Mr. Smith will begin the next day's period with a review of formulas that help calculate circumference and energy expended. His objectives are to help students understand why the formulas work based on their experience of the previous day and to have students think about other applications of the relationships discovered through the water wheel task.

*A visit to a low performing school reveals an equally dedicated principal and faculty who are trying to do what they believe works for students.*

## Low-Performing

As you walk into Low Performing Middle School, a blanket of quiet descends. You see no one in the halls, but you are reminded by large signs that you must report to the office or be subject to a fine under law. As you enter the principal's office, the secretary is busy dealing with students. Students fill the office, and each has a piece of paper that requires attention. After clearing out some of the crowd, the secretary buzzes the principal to let him know you have arrived. The principal emerges from his office, welcomes you, and suggests that you come into his office for a briefing before you visit classrooms.

The principal provides a general description of the community, staff and students that is clear and knowledgeable. He explains, "because so many of our students have little structure in their lives outside of school, we believe that we must provide structure so that they have an opportunity to learn what they need to know. There is research supporting the effectiveness of structured, whole class instruction—especially for low-achieving students. We strongly believe that is right."

After the briefing, the principal walks with you to the science classroom, the first of four classrooms you will visit. He introduces you to the teacher and requests that you return to the office when the period ends and before you visit the next classroom. The teacher is completing a roll call of the class. He is about to begin a demonstration of how to construct a pulley, one of the six simple machines. During the demonstration, some of the students have their heads down on their desks, and others are busy doing what appears to be mathematics homework. As the demonstration ends, he asks if there are any questions. No one raises a hand. He then instructs the students to open their books to chapter 8. He moves to his desk to retrieve the textbook, and asks the student sitting at the back of the first row to begin reading aloud from chapter 8. Fifteen minutes have gone by.

Students are seated in neat rows in the classroom, and there are commercial posters on the walls illustrating the six simple machines. Classroom rules related to clothing, behavior and work are also posted. The students continue to read from the chapter, a paragraph at a time. When a student hesitates on a word, the teacher quickly provides the correct pronunciation. As a student completes a paragraph, the teacher asks, "What is that paragraph telling us?" If no one volunteers, he selects a student to answer. As the chapter is completed, he tells the students to begin answering the questions at the end of the chapter. "Complete these questions and hand them in at the beginning of the class period tomorrow."

Students begin to search for paper and pencils; some do not have either and must admit that to the teacher or find someone to give them paper and a pencil. The class is finally working on the questions when the bell signaling the end of the 50 minute class period rings. Students surge toward the hall, and the noise level rises as they chatter and move toward other classrooms.

*(continued on page 16)*

## Low-Performing (cont'd)

The teacher and principal explain later that you have observed a general science class. In this class, students will complete the textbook and do a science project and a research paper by the end of the year. Eighth grade students take either general science, physical science (for the more advanced students) or consumer science, a course that concentrates on health, nutrition and everyday science for the less able student. The science department examined student data to find out why performance was lower than expected. They decided to emphasize both process and content. To that end, they begin most class periods with a teacher demonstration of an experiment or concept, and students spend one day each week in a laboratory replicating an experiment and recording it in lab books.

*In both of these schools and in the classrooms observed, teachers were planning and working to improve student achievement. One classroom emphasized student work, and the other classroom was centered on the teacher's work. Their results are quite different because how schools and teachers go about their business makes a difference in student achievement.*

## Some differences between high and low performing schools

**Students in high performing schools are expected to do more, and high-performing schools provide more challenging curriculum.** Successful schools emphasize higher level academics and the intellectual development of students in the middle grades as opposed to schools that concentrate most of their energy on social development and are satisfied with achievement on low-level skills. High-performing schools and districts align all the parts of the educational system—curriculum, instruction, assessment and student support—and all the participants—the community, school boards, administrators, teachers, students and parents—to achieve challenging standards.

**Expectations are clearly defined and widely supported.** In high-performing schools, most parents and students have a clear vision and understanding of challenging standards for achievement by eighth grade. Schools, districts and states establish clear benchmarks for entrance into ninth grade and provide more time and more help for those students who have not mastered challenging content. Parents work with middle grades educators to define and achieve the standards in a challenging middle grades curriculum.

**Teachers in high-performing schools are prepared to teach challenging content in mathematics, science and reading and to teach young adolescents.** Administrators oversee a system designed to emphasize planning, collaboration and development of quality learning experiences by staff and faculty. Teachers and administrators believe that they can support the unique developmental needs of adolescents and offer a challenging learning experience. School boards and school and community leaders are ready to develop new policies to create a different system that ensures high performance for all students.

These differences are conditions that legislators, state educational leaders, local educational leaders and middle grades educators, parents and community leaders need to consider as they work to help all schools and students become successful.

## Looking Ahead

Three more reports will examine the current condition of middle grades education in the 15 states that comprise the region served by the Southern Regional Education Board. Observations in schools and classrooms across the region will provide examples of current practice in the middle grades. The reports will incorporate data from the school visits to examine standards and expectations, teacher preparation and professional development and the "best practices" of schools whose students are achieving at high levels.